PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project	
Cedar Creek Natural Production and Watershed Monitoring Project	
BPA project number	**20109**
Contract renewal date (mm/yyyy)	
Multiple actions? (indicate Yes or No)	**YES**
Business name of agency, institution or organization requesting funding	
Washington Department of Fish and Wildlife	
Business acronym (if appropriate)	**WDFW**
Proposal contact person or principal investigator:	
Name	**Dan Rawding**
Mailing address	**2108 Grand Blvd.**
City, ST Zip	**Vancouver, WA 98661**
Phone	**(360) 906-6747**
Fax	**(360) 906-6776**
Email address	**rawdidr@dfw.wa.gov**
NPPC Program Measure Number(s) which this project addresses	
2.2A, 2.2C, 3.2, 3.3, 4.2, 4.3, 7.0C, 7.1A,C&F, 7.2, 7.3, 7.4A,B&F, 7.5C,D,E&F, 7.6, 8.1, 8.4	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
Because ESA listings are new, NMFS biological opinions have not been developed for Lower Columbia River steelhead, chum and chinook salmon	
Other planning document references	
State of Washington's - Lower Columbia Steelhead Conservation Initiative and Statewide Salmon Strategy-Extinction is not an Option; National Marine Fisheries Service - Working guidance for comprehensive salmon restoration initiatives on the Pacific Coast; Washington Department of Fish and Wildlife - Wild Salmonid Policy; Lewis River Subbasin Plan; Independent Science Group - Return to the River	
Short description	
Estimate juvenile production and adult escapement for coho, cutthroat, steelhead, chinook, and possibly lamprey to support local watershed restoration projects and recovery of fish populations listed under the Endangered Species Act.	
Target species	
coho salmon, steelhead, sea-run cutthroat, chinook salmon, chum salmon, and pacific lamprey	

Section 2. Sorting and evaluation

Subbasin
Lewis River - Cedar Creek

Evaluation Process Sort

CBFWA caucus		**CBFWA eval. process**		**ISRP project type**	
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories	
X	Anadromous fish	X	Multi-year (milestone-based evaluation)	x	Watershed councils/model watersheds
	Resident Fish	x	Watershed project eval.	x	Information dissemination
	Wildlife				Operation & maintenance
					New construction
				X	Research & monitoring
				X	Implementation & mgmt
					Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	**Project title/description**
20543	Coded Wire Tag Program
8906600	Annual Stock Assessment - Tagging Program (WDFW)
8906900	Annual Stock Assessment - Tagging Program (ODFW)
8906500	Annual Stock Assessment - Tagging Program (USFWS)
8201300	Coded Wire Tag Recovery Program (PSMFC)

Other dependent or critically-related projects

Project #	**Project title/description**	**Nature of relationship**
9600800	PATH-Participation by State and Tribal agencies	Provide wild salmon and steelhead escapement, smolt production, freshwater and marine survival for below Bonneville populations
9145	Evaluate the Status of Columbia River Sea-run Cutthroat	Provide cutthroat scale and genetic samples
9800100	Analytical Support-PATH & ESA Biological Opinions	Provide wild salmon and steelhead escapement, smolt production, freshwater and marine survival for

		below Bonneville populations
960400	Evaluate the feasibility and risk of coho salmon reintroduction in the Mid-Columbia	Provides information on success/or failure of coho salmon rebuilding and potentially a wild donor stock
9005200	Performance/Stock Productivity Impacts of Hatchery Supplementation	Address coho supplementation to be compared with steelhead and chinook in 9005200
Umbrella	Yakima/Klickitat Fisheries Project	Provides information on the success/or failure of Coho rebuilding and potentially a wild donor stock
9104	Conduct baseline habitat and population dynamics studies on lamprey in Cedar Creek	Collect adult and juvenile lamprey data to support this project

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Estimate the total number of chinook, coho, steelhead, sea-run cutthroat, and lamprey spawners in Cedar Creek	a	install adult trap, check trap daily, enumerate fish, floy tag, paper punch for secondary mark, and release fish
		b	conduct salmon carcass surveys to determine tag retention and the number of fish passing upstream but not using fish ladder
		c	construct database, analyze, write report
2	Monitor the age structure, biological characteristics, and genetic diversity of fish populations	a	remove scales from sampled fish and determine ages
		b	obtain genetic samples and conduct analysis

Obj 1,2,3	Objective	Task a,b,c	Task
3	Determine the stray rate of adult hatchery coho, chinook, cutthroat, and steelhead from Lewis River and Merwin Hatcheries and limit hatchery spawners to Wild Salmonid Policy guidelines	a	enumerate adipose fin clipped and non-adipose fin clipped coho, steelhead, and cutthroat
		b	since some hatchery coho are not adipose fin clipped, scan coho for presence of coded wire tags
		c	sacrifice coded wire tagged hatchery fish to determine origin of strays
4	Determine smolt production estimates for steelhead, cutthroat, and coho, presmolt chinook production, and the feasibility for juvenile lamprey estimates	a	install a screw trap at river mile 2, enumerate captured fish by species, mark and release a portion of trap catch, enumerate the number of recaptures
		b	coded wire tag smolts and release downstream of trap
5	Determine key spawning and rearing areas within the basin based on a life cycle monitoring approach	a	document redd locations during conducting carcass surveys
		b	document adult holding locations during snorkel surveys
		c	install juvenile traps at 3 locations in the watershed and monitor smolt and parr production
		d	document potential chum spawning areas during redd & carcass surveys
6	Determine the freshwater survival (egg to presmolt/smolt) and marine survival (presmolt/smolt to adult) for cutthroat, steelhead, and coho, chinook and possibly lamprey.	a	freshwater survival - estimate total escapement and smolt production from this brood
		b	marine survival - estimate the wild adult return by smolt outmigration year

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/2000		number of adult spawners		25
2	10/2000		age and genetic baseline for sampled spawners		3

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
3	10/2000		number and origin of hatchery spawners in Cedar Creek		2
4	10/2000	9/2005	use trap efficiency to estimate smolt production and use back calculation to estimate		25
5	10/2000	9/2003	redds by stream reach and parr and smolt estimate by trap site		40
6	10/2000	9/2005	freshwater and marine survival by species		5
				Total	100%

Schedule constraints
Assumptions are made that we will continue to have landowner access and support for surveys and juvenile trapping. NMFS will continue to issue permits for work.
Completion date

Section 5. Budget

FY99 project budget (BPA obligated):	$ **new project**

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel		26	57946
Fringe benefits		9	19702
Supplies, materials, non-expendable property		3	6620
Operations & maintenance		3	6000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		33	74000
NEPA costs		0	0
Construction-related support		0	0
PIT tags	# of tags:	0	0

Travel		3	6480
Indirect costs		8	18651
Subcontractor	USFWS	16	36500
Other			
TOTAL BPA REQUESTED BUDGET			$225,899

Cost sharing Over $1,000,000 was spent in FY97 and 98 however no commitment available in FY2000. If stays the same in fy 2000 then $1,200,000 is projected.

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Fish First	riparian fencing and planting		
Clark County Conservation District	riparian fencing and planting		
Clark County	culvert repair		
WDFW	personnel		
USFWS	equip supply & and personnel		
Total project cost (including BPA portion)			

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	223200	150000	150000	150000

Section 6. References

Watershed?	Reference
	Bailey, N.T.J. 1951. On estimating the size of mobile populations from recapture. Biometrika 38:293-306.
	Efron, B. and R. Tibshiriani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical Science 1:54-77
	Hale, D., T Coley, and D Rawding. Cedar Creek salmonid investigation. Progress Report.
	ISG (Independent Science Group). 1996. Return to the River: Restoration of salmonid fishes in the Columbia River Ecosystem. No. 96-6. Northwest Power Planning Council, Portland, OR.
	Knudsen, E.E. Managing pacific salmon escapements: the gaps between theory and reality. U.S.Geological Survey, Biological Resources Division. Proceedings from the Sustainable Fisheries Conference. In press. Anchorage, AK
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	Marmorek, D.R. (Ed.), J.J. Anderson, L. Basham, D. Bouillon, T. Cooney, R.

	Dersio, P. Dygert, L. Garrett, A. Giorgi, O.P. Langness, D. Lee, C. McConnaha, I. Parnett, C.M. Paulsen, C. Peters, C.E. Petrosky, C. Pinney, H.A. Sch aller, C. Toole, E. Weber, P. Wilson, and R.W. Zabel. 1996. Plan for Analyzing and Testing Hypotheses (PATH); Final report on retrospective analysis for fiscal year 1996. Compiled and edited by ESSA Technologies Ltd., Vancouver, B.C.
	Murphy, M.L., J.F. Thedinga, and J.J. Pella. 1996. Bootstrap confidence intervals for trap efficiencies of migrating fish. National Marine Fisheries Service, Juneau, AK.
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	State of Washington. 1998. Lower Columbia Steelhead Conservation Initiative. Draft. Olympia, WA.
	State of Washington. 1998. Statewide Strategy to Recover Salmon. Draft. Olympia, WA.
	Thedinga, J.F., S.W. Johnson, K.V. Koski, J.M. Lorenz, and M.L. Murphy. 1994. Determination of salmonid smolt yield with rotary screw traps in the Situk River, Alaska, to predict the effects of glacial flooding. North American Journal of Fisheries Manaagement 14:837-851.
	Washington Department of Fisheries, Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State salmon and steelhead stock inventory. Olympia, WA.
	WDFW. 1995. Wild Salmonid Policy - draft environmental impact statement. Olmpia, WA.
	WDF and WDW. 1990. Lewis River Subbasin salmon and steelhead production plan. Columbia Basin System Planning, Northwest Power Planning Council, Portland, OR.

PART II - NARRATIVE

Section 7. Abstract

WDFW proposes natural production monitoring of chinook salmon, coho salmon, steelhead, sea-run cutthroat trout, and pacific lamprey populations in Cedar Creek to support ongoing habitat projects, preserve genetic diversity, and aid in recovery of declining wild stocks. Lower Columbia River steelhead have been listed as threatened under the Endangered Species Act (ESA). Fall chinook and chum salmon are proposed for listing as threatened, and coho salmon are a

candidate species under the ESA. NMFS has expressed concern over the recent decline in anadromous cutthroat and a proposed listing determination is scheduled for December 1998. Cedar Creek, a tributary to the North Fork Lewis River and within the Lower Columbia region is unique because it supports all of the fish species listed or likely to be listed and has an adult collection facility and a juvenile trap site to support accurate scientifically sound population estimates. The proposed natural production monitoring will permit objective evaluation of ongoing local (non-BPA funded) habitat restoration efforts. The life-cycle/key production area monitoring is the first step to complete a watershed assessment, which can be used to apply limited restoration funds to projects that will be the most successful. Adult trap operation maintains genetic diversity by limiting access of hatchery sea-run cutthroat trout and steelhead spawners to wild steelhead and cutthroat spawning areas in the upper basin. Further, operation of the trap will allow an evaluation of an ongoing supplementation project to recover coho salmon production in the basin. The information learned in the coho and steelhead recovery portion of this project will help managers address key uncertainties in reintroduction and recovery efforts both in the Lewis Basin and importantly, in ongoing work supported by state, federal, and tribal agencies above Bonneville dam.

Section 8. Project description

a. Technical and/or scientific background

Cedar Creek is a third order stream with a drainage area of 55 square miles and enters the North Fork Lewis River at river mile 15.7. This tributary is a key production area for natural anadromous fish populations in the Lewis River subbasin after the construction of Merwin Dam in 1931 eliminated access to over 150 miles of habitat. Wild steelhead, sea-run cutthroat trout, coho salmon, chinook salmon, and pacific lamprey are produced in Cedar Creek. In addition, chum salmon were observed in 1998. The status of these wild populations is depressed or believed to be depressed (WDF et al. 1994, WDFW 1997, and Donna Hale, personal communication). Cedar Creek lies within the Lower Columbia River Evolutionary Significant Units for each of the species listed. The National Marine Fisheries Service (NMFS) has listed steelhead as threatened under the Endangered Species Act (ESA), proposed to list fall chinook salmon and chum salmon as threatened under the ESA, and has listed coho salmon as a candidate species under the ESA. NMFS has expressed concern over the recent decline in anadromous cutthroat and a proposed listing determination is scheduled for December 1998.

Maintaining healthy populations of anadromous fish in Cedar Creek has strong federal, state, and local support in both the planning and implementation phases. The federal support for recovery is evidenced by NMFS listing of fish under the ESA, Coastal salmon conservation: working guidance for comprehensive salmon restoration initiatives on the Pacific Coast, and the steelhead biological opinion **(** NMFS 1996, and NMFS 1998). In Washington both state and regional plans have been created to rebuild wild stocks. The Washington Fish and Wildlife Commission adopted the Wild Salmonid Policy (WSP) “to protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems...” (WDFW 1997). In 1998 the Governor’s Office released a draft of the State Salmon Strategy -- Extinction is not an Option, following a draft release of the Lower Columbia Steelhead Conservation Initiative (State of Washington

1998a and 1998b). In addition the Washington State Legislature appropriated $36 million for statewide salmon recovery efforts and enacted several bills relating to fish recovery and habitat restoration (e.g. ESHB 2496, 2514, and 2836). In the Statewide Strategy to Recover Salmon, the Lewis River watershed has the highest priority. Further state action has included the Department of Natural Resources adopting emergency rules to limit activities with the riparian zone and the development of Habitat Conservation Plans for state forest lands. Planning at the local level includes growth management planning, review of county ordinances, and a survey and prioritization of fish passage problems on county roads.

The factors that have caused wild steelhead to decline are listed in Washington's State Salmon and Steelhead Stock Inventory, Factors for decline: a supplement to the notice of determination for west coast steelhead under the Endangered Species Act, LCSCI, and Lewis River Subbasin Plan (WDF et al. 1994, NMFS 1996, State of Washington 1998, and WDF et al. 1990). Wild fish populations will continue to exist below their potential unless actions are taken that restore natural watershed processes through active and passive restoration projects, use innovative hatchery practices to meet mitigation objectives while minimizing ecological and genetic risks to wild populations, and reduce fisheries harvest to protect weak stocks while targeting abundant hatchery stocks. There has been a recent activity to address these factors of decline from federal, state, and local agencies. WDFW has worked with co-managers to reduced harvest rates on Lower Columbia River wild fish populations. For example, from the mid-1980's to the mid 1990's harvest was reduced from over 50% to less than 3% for wild steelhead, from over 60% to less than 15% for wild coho, and chinook salmon received a similar reduction in harvest rates (Cindy LeFleur, personal communication). PacifiCorp and WDFW are studying return rates of hatchery sea-run cutthroat and steelhead from a volitional release/trucking operation in which hatchery smolts are released below the primary wild fall chinook rearing area (Todd Hilson, personal communication).

A holistic approach to watershed restoration has been recommended (NPPC 1995, ISG 1996, NMFS 1997, and State of Washington 1998). The landownership in Cedar Creek is dominated by private holdings, with limited state and federal holdings. The ability to work with diverse individuals and groups in the basin is a must and Fish First, a local fishing and conservation organization, has demonstrated a very successful track record in completing habitat projects with private landowners. Due to the high natural production potential of Cedar Creek, Fish First has focused its restoration efforts in that basin. Participants in Cedar Creek habitat projects include representatives from businesses, government agencies, recreational users, timber industry, agriculture, and landowners. Chosen restoration projects have considered proposals across all land ownerships and are ranked based on a variety of factors including addressing known degraded habitat and water quality problems, likelihood of success, and landowner and community support.

These non-BPA funded efforts have focused on restoring natural watershed processes identified in the Lewis River Subbasin Plan and LCSCI using passive and active techniques (WDF et al. 1990, State of Washington 1998). These projects have: 1) reconnected fish habitat blocked by poorly design culverts, 2) protected riparian areas by fencing, and 3) increased shade, rearing habitat, future large woody debris recruitment, and channel stability, while decreasing water temperature and sediment transport through riparian plantings. In 1998 over $1,000,000 was used to fund

projects, which fixed 2 culverts that improved access to over 13 miles of stream; fenced over 10,000 feet of stream to protect riparian areas from livestock; moved livestock waste away from the stream corridor, and replanted 10,000 feet of riparian area. We expect state and local funding to continue and projects totaling over $2,000,000 are being considered for funding in FY1999.

This project proposes to monitor natural production of chinook salmon, coho salmon, steelhead, sea-run cutthroat trout, and pacific lamprey populations in Cedar Creek to support ongoing habitat projects, preserve genetic diversity, and recover ESA listed wild stocks. Monitoring the recovery of natural populations is an important adaptive management strategy that will enable us to apply success strategies and not repeat our failures in other subbasins as the entire Columbia River Basin moves into a period of rebuilding at-risk wild stocks. The proposal supports evaluation of current local non-BPA funded habitat restoration efforts and the life-cycle/key production area monitoring is the first step to complete a watershed assessment, which can be used to apply the limited restoration funds to projects that will be the most successful. Adult trap operation maintains genetic diversity by limiting hatchery spawners for sea-run cutthroat trout and steelhead and allows an evaluation of a supplementation project to recover coho salmon (State of Washington 1998, WDFW 1997). The fisheries agencies and tribes have initiated a process to re-introduce coho into areas above Bonneville Dam from which they have been extirpated and have expressed a desire to recover wild steelhead populations in this same area. The information learned in the coho and steelhead recovery portion of this project will help the upriver managers address key uncertainties in their reintroduction and recovery efforts. Furthermore, there are few streams which have the facilities like those present on Cedar Creek (e.g. efficient fish ladder and downstream juvenile trap site) that allow for the application of rigorous scientific methods for monitoring recovering populations.

We propose this as a multi-year project for a number of compelling reasons: 1) total multi-species estimates of wild escapement below Bonneville are rare to non-existent for chinook, coho, and cutthroat; 2) we believe annual climatic variations are related to fluctuations in freshwater and ocean productivity and fish populations should be monitored for a number of years to encompass this variation; 3) determination of marine survival is based on adult returns which for some salmon species can be up to 4 years after juvenile outmigration; 4) the effect of current management action will be realized in future fish generations.

b. Rationale and significance to Regional Programs

This proposal addresses many of the Northwest Power Planning Council Fish and Wildlife Program measures due to its multi-species scope, rebuilding framework, watershed approach, and monitoring and evaluation design. The project is located within the Lewis River subbasin, where hydroelectric development has blocked anadromous fish from accessing over 150 miles of habitat. The primary goal of this program to monitor and support the recovery of at risk stocks in Cedar Creek through an evaluation of the cumulative fish response of recently enacted measures to improve habitat, reduce harvest rates, and foster genetic diversity. Strong federal, state, and local plans and recovery actions are being implemented that address known factors for decline. The WDFW, USFWS, Fish First, PacifiCorp, Clark County, Clark County Conservation District,

local property owners, and others have invested well over $1 million for fish recovery in Cedar Creek. However, we do not have the necessary funding to evaluate the effectiveness of habitat restoration measures, harvest rate reductions, and hatchery practice modifications. Therefore, we are asking for a partnership with BPA in this process to help it be successful and to learn from these local actions to make other Columbia River basin recovery efforts successful. NPPC measures 2.2C and 9.1 state a need for partnerships and sharing the cost of salmon recovery and this program has demonstrated effectiveness in this area.

This proposal is focused on rebuilding wild coho salmon, chinook salmon, steelhead, sea-run cutthroat, and possibly lamprey. The populations are listed, proposed to be listed, candidate for listing, or in review by NMFS under the ESA. These are native species in native habitat (2.2A) and the following measures address rebuilding of Lower Columbia River coho salmon (7.5C, 7.5C.1, 7.5C.2, 7.5C.3 7.5C.4), Columbia River sea-run cutthroat trout (7.5 E, 7.5E.1, 7.5E.2, 7.5E3), Columbia River chum salmon (7.5 D, 7.5D.1, 7.5D.2, 7.5D3,), and pacific lamprey (7.5F, 7.5F.1). Since these salmonids are either listed or proposed to be listed under the ESA, this project addresses a significant regional challenge to recover these populations.

We holistically address Section 7 of the Fish and Wildlife Program, which deals with coordinated salmon production and habitat. This project addresses many measures in this section. The Lewis River Subbasin Plan (WDF et al. 1990) was produced a decade ago and measure 7.OC supports the updating of subbasin plans. The proposal will increase biodivesity by limiting the number of hatchery spawners and determine the origin of hatchery spawners (7.1), promoting adaptive management within our hatcheries. Smolt production estimates and spawner recruit curves will be used to evaluate carrying capacity (7.1A). The adult and juvenile trapping will allow collection on population status, life history, and other data on naturally spawning populations (7.1C).

The fisheries agencies and tribes have initiated a process to re-introduce coho into extirpated areas above Bonneville Dam and have expressed a desire to recover wild steelhead populations in this same area (Columbia River Fish Management Plan). It is estimated that approximately 70% of the Cedar Creek natural escapement for steelhead and coho are hatchery fish (WDFW, unpublished data). Since the Cedar Creek and Bonneville hatchery proportions are similar, Cedar Creek has excellent potential to evaluate coho rebuilding without the influence of the hydrosystem. The information learned in the coho and steelhead recovery portion of this project will help the upriver managers address key uncertainties in their reintroduction and recovery efforts. As WDFW implements coho and steelhead recovery the proportion of hatchery spawners will be reduced to allow local adaptation of wild stocks. This process will allow for a natural production evaluation of supplemented and non supplemented populations. Furthermore, healthy lower river populations may provide options for the use of wild broodstock for upper river re-introduction. This proposal addresses supplementation risk assessments, implementation and evaluation plans (7.3).

Sustainable fisheries are regulated to meet established spawner abundance, genetic conservation, and harvest objectives. Adipose fin marking programs have lead to the development of selective fisheries for steelhead (1986), coho (1998), and Williamette Spring chinook (2000). Selective fisheries and adipose marking have allowed the fisheries agencies to increase wild escapement and

focus on wild fish management. By monitoring natural production, habitat based escapement goals can be developed for Cedar Creek. A long-term monitoring program would establish a spawner recruit database to develop MSY escapement goals and address habitat conservation measure (8.1 and 7.6). Cedar creek wild smolt and jack salmon estimates will be used to predict wild run size of each species (8.4). Currently the only Lower Columbia River wild fish that are forecast are fall chinook.

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There are few streams which have the facilities like those present on Cedar Creek (e.g. efficient fish ladder with adult trap and downstream juvenile trap site) that allow for the application of rigorous scientific methods to monitor recovering populations. The work proposed by WDFW would provide detailed steelhead, chinook, coho, cutthroat, and lamprey life history trajectories (movements through time and space) for all species. These data are lacking in Cedar Creek, the Lower Columbia ESU, and particularly for species such as steelhead, cutthroat, and coho with extended freshwater residency. Life history trajectories will be available to help prioritize the approximate $1,000,000 of non-BPA funded habitat projects, and will form the basis for future development of an Ecosystem Diagnosis and Treatment Analysis for this basin and others (Lestelle et al. 1996). The smolt to adult returns (SAR's) is likely to be heavily relied upon by the PATH project, subsequent recovery planning in this ESU, and Columbia River recovery plans for species where SAR's are lacking such as sea-run cutthroat trout, coho salmon, and steelhead. These data can be used as controls to evaluate the effect of the hydroelectric operations and fish recovery efforts since this basin is below Bonneville Dam and is not as directly influenced by hydro operations.

c. Relationships to other projects

There are plans to re-introduce coho into Umatilla, Klickitat, Yakima, Wenatchee, and Methow subbasins using lower river stocks such as Lewis River stocks through supplementation. (NPPC proposals 960400, 9603302). Few programs have been set up to monitor performance and stock productivity impacts of hatchery supplementation. For steelhead and spring chinook these impacts are addressed, however these are not being addressed for coho which have been cultured in the Lewis Basin since 1931 (NPPC proposals 9005200, 9506406). Wild Lower Columbia River coho salmon are depressed and NMFS has listed them as candidate species under ESA. Previously, Mitchell Act facilities have produce many coho smolts for a supplementation program with a harvest emphasis. Currently, the coho program has added a supplementation program with a rebuilding emphasis. WDFW has proposed a framework to recover Lower Columbia Coho through the reduction of harvest rates, decrease the proportion of hatchery fish spawning in the wild, and habitat recovery (WDFW-1995). As WDFW implements the WSP, including selective fisheries and better hatchery management practices, wild coho stocks are expected to rebound. Our change in management gives us the opportunity to evaluate the recovery of wild coho from a supplementation program, these opportunities are rare and the results from such a project will have regional applications.

The 1995-98 NMFS biological opinion on the operation of the Federal Power System created a process called PATH--Planning for Analyzing and Testing Hypothesis to ensure the region has the benefit of the best available scientific information in analyses for recovery plans for listed ESA populations, section 7 consulations, and for development of fish recovery programs (NPPC proposal 9600800). PATH has used historic smolt to adult return rates (SAR) for their retrospective analysis of spring chinook (Marmorek, D.R. (ed). 1996). Further, it is likely that SAR's will be important in the coho salmon, steelhead, and sea-run cutthroat analyses. However, data are lacking for these species and PATH process has recommendation for the region to establish representative index streams where total escapements are measured for a variety of wild stocks to assess regional trends in anadromous fish populations. Knudsen (1997) indicated that trap/weir counts are the most accurate for estimating escapements. Cedar Creek has a facility that enable accurate estimatation of populations and trends.

The coded wire tag recovery program (CWT) is the most important identification tool to evaluate salmon and steelhead fisheries and stocks on the West Coast. CWT tagging (NPPC proposals 8906600, 8906900, and 8906500) of hatchery fish by fisheries agencies and recovery (NPPC proposal 82013000) are used to assess hatchery performance and improve hatchery survival. With mounting concerns for wild fish, recent tagging data have also been used in assessing genetic risk by determining stray rates of hatchery fish. Because coho spawn during periods of high water success has been limited in determining hatchery coho stray rates because of the staff required to sample the entire watershed has been limited. A scoping project indicates that 70% of the hatchery steelhead and salmon use the fish ladder on Cedar Creek. CWT recoveries will increase from <5% to 70% in Cedar Creek allowing an accurate assessment of hatchery salmon and steelhead stray rates in the North Fork Lewis River.

This project may appear to encompass the USFWS Cedar Creek lamprey proposal (9104). Since few lamprey use the fish ladder and their out migration timing is fall/early winter, there is little overlap in these proposals. The multi-agency cutthroat proposal (9145) is broad in scope and this proposal would be supportive by providing scale and genetic samples. However, the natural production monitoring in this proposal would address areas not covered in the multi-agency cutthroat proposal such as smolt production, freshwater and marine survival, adult escapement, and key production areas.

d. Project history (for ongoing projects)

NEW PROJECT

e. Proposal objectives

This project will assess the natural escapement and productivity of spring and fall chinook salmon, summer and winter steelhead, coho salmon, sea-run cutthroat trout, and lamprey from Cedar Creek to support the ongoing non-BPA funded fish habitat improvement projects, develop natural production information for these proposed or listed species that will assist in fish and watershed recovery plans in the subbasin, and to support ESU and Columbia River Basin efforts.

The specific proposal objectives are:

1) Determine the total number of chinook, coho, steelhead, sea-run cutthroat, and possibly lamprey spawners in Cedar Creek;
2) Monitor the age structure, biological characteristics, and genetic diversity of these fish populations;
3) Determine the stray rate of adult hatchery coho, chinook, cutthroat, and steelhead from Lewis River and Merwin Hatcheries and limit hatchery spawners to Wild Salmonid Policy guidelines;
4) Determine smolt production estimates for steelhead, cutthroat, and coho, presmolt chinook production, and the feasibility for juvenile lamprey;
5) Determine key spawning and rearing areas within the basin based on a life cycle monitoring approach including identification of potential chum spawning areas; and
6) Determine the freshwater survival (egg to presmolt/smolt) and marine survival (presmolt/smolt to adult) for cutthroat, steelhead, and coho, chinook and possibly lamprey.

f. Methods

This project will follow a similar approach as ongoing steelhead natural production monitoring in the Wind River. The study design incorporates proven scientific approaches that allow for population estimates with confidence intervals. In 1998 the Cedar Creek basin was surveyed for this proposal and scoping work has already taken place (Hale et al. 1998).

Objective 1) Determine the total number of chinook, coho, steelhead, sea-run cutthroat, and possibly lamprey spawners in Cedar Creek.
Conditions such as high flow, turbid water, and limited access in Cedar Creek make adult, redd, and/or carcass surveys problematic. Due to these and other considerations Knudsen (1997) indicated that weir or trap counts provide the most accurate measure of salmon spawning escapement. Adult escapement estimates will be made using an existing trap in the Grist Mill fish ladder located at River Mile 2. Since it is possible for fish to jump the falls adjacent to the ladder, population estimates will be calculated using a Petersen estimator. Trapped fish will be classified, enumerated, bio-sampled, floy tagged, paper punched, and released upstream. Salmon carcass surveys will determine the ratio of tagged to untagged fish. The secondary mark (paper punch) will allow us to determine tag loss. Since steelhead and cutthroat trout do not die after spawning the estimate of salmon jumpers correlated with flow will be used unless water conditions permit an actual measurement through snorkel surveys. The number of lamprey using the ladder is believed to be low compared to those using the falls (Travis Coley, personal communication), Therefore due to the low mark rate it may be difficult to obtain an accurate lamprey population estimate.

Objective 2) Monitor the age structure, biological characteristics, and genetic diversity of fish populations.
All fish species will be sampled at the trap. Length, sex, and life history stage will be noted and six scales will be removed from the preferred area. Fish will be scanned for coded wire, fin marks, tags and tag scars, secondary tags, and marine mammal scars. Age structure will primarily be

determined using scale analysis. Since outmigrating smolts will be coded wire tagged, recovery of tags from carcasses upon adult return will provide validation of saltwater age. Allozyme electrophoresis and microsatellite DNA (msDNA) methods will both likely be used. Baseline allozyme data for steelhead and cutthroat from Cedar Creek and other nearby subbasins is available but the likelihood for requirement of non-lethal sampling methods (i.e. muscle tissue only) may limit the value of allozyme analysis alone. Emerging msDNA techniques, in development at WDFW's Genetics Laboratory and elsewhere, are very likely to be in widespread use by FY2000 and are expected to complement (and perhaps eventually replace) use of the allozyme methods. Genetic sampling of wild populations is proposed every five years to assess population changes. Genetic analysis will be conducted at the WDFW Genetics Laboratory in Olympia. Sample collection and analysis will follow protocols developed at the lab.

Objective 3) Determine the stray rate of adult hatchery coho, chinook, cutthroat, and steelhead from Lewis River and Merwin Hatcheries and limit hatchery spawners to Wild Salmonid Policy guidelines.

All steelhead, coho, and sea-run cutthroat smolts released from the Lewis River hatcheries are adipose clipped and will be easily distinguished from wild fish as returning adults. Plans are being considered to adipose clip all spring chinook. For now, a portion of the hatchery chinook releases are coded wire tagged and estimates of escapement of hatchery origin chinook into Cedar Creek will be accomplished by recovery of tagged fish in the trap.

Objective 4) Determine smolt production estimates for steelhead, cutthroat, and coho, presmolt chinook production, and the feasibility for juvenile lamprey.

We propose to develop annual estimates of coho, steelhead, and cutthroat smolt and chinook presmolt production for Cedar Creek. The proposed trap sites will be located at the mouth or Grist Mill (river mile 0-2) for a total production estimate. To determine smolt outmigration, traps will be fished from March through July which coincides with smolt outmigration timing (Hale et al, in prep). Traps will be checked daily and fish anesthetized. Bio-sampling will include obtaining length, weight, and scale data. Smolt enumeration estimates will be made using both the trap efficiency method and the adult back calculation method (Thedinga et al. 1994 and Seiler et al. 1997) . For the trap efficiency method a representative sample of fish will be marked and released upstream of the trap. Weekly trap efficiencies will be determined by Bailey's (1951) modification to the Petersen estimator. Short-term mark retention and survival will also be measured and used to adjust estimates of trap efficiency (Murphy et al. 1996). Variances will be determined using a bootstrap method (Efron and Tibshirani 1986). The second independent method (adult back calculation) for estimating smolt production will be used concurrently with the trap efficiency method. Adult back calculation involves placing coded wire tags in all outmigrating smolts captured at the trap. The proportion of tagged to untagged returning adults captured in the adult trap in subsequent years will be used to derive actual smolt outmigration estimates to complement and validate the trap efficiency method.

Objective 5) Determine key spawning and rearing areas within the basin based on a life cycle monitoring approach including identification of potential chum spawning areas.

Salmon carcasses will be recovered to determine the proportion of fish that do not use Cedar Creek fish ladder. These surveys will enable use to identify key chinook and coho spawning

areas. Snorkel or redd surveys will help identify steelhead and cutthroat areas. Since chum salmon were believed to be present in the basin we will identify spawning areas with potential for this species to support a WDFW initiative to rebuild wild chum populations.

A series of outmigrant traps at 1) at the mouth of Chelatchie Creek, 2) upper Cedar Creek (river mile 11), and 3) a single trap to rotate on an annual basis between Pup, John, Brush, and Bitter Creeks. Traps would consist of a rotary screw traps for Cedar Creek and downstream V-wier traps for tributaries. After the smolt outmigration is concluded the three traps will be fished through October to determine juvenile movements. Smolt and parr estimates will be calculated using the methodology outlined in Objective 4.

Objective 6) Determine the freshwater survival (egg to presmolt/smolt) and marine survival (presmolt/smolt to adult) for cutthroat, steelhead, and coho, chinook and possibly lamprey. Adult and smolt production estimates for Cedar Creek will be determined by accomplishing Objectives 1 and 4. Marine survival will be derived from adult escapement and smolt production estimates. In this case marine survival includes the Lewis/Columbia River migration corridor. Freshwater survival will be calculated as both smolts per female and smolts per spawner.

g. Facilities and equipment

An adult trap is located in the Grist Mill fish ladder at river mile 2 on Cedar Creek. Based on our 1998 scoping study, facility improvement may be needed including debris screening, and modification of weirs to reduce impinging and facilitate cleaning. Three rotary screw traps (5 ft. diameter) are required for the smolt estimates along with one V-style outmigrant trap. One GSA pickup is needed for field work and a computer will be required for database development and analysis. The coded wire tagging requires a mark IV tagger and a trailer. Other equipment includes miscellaneous adult and juvenile trapping supplies and office supplies.

h. Budget

The total budget is $223,000. Major purchases include: 4 juvenile outmigration traps, 1 computer, and miscellaneous adult and tagging supplies. The traps are needed to produce juvenile estimates, and the computer and software are needed for data management and analysis. The subcontract is with the USFWS a partner on this project with us. Their subcontract covers onemonth of biologist assistance in data analysis and nine months of technical assistance. The WDFW staff time includes a year round Biologist 2 as the field leader and nine months of scientific technician time. Field duties include biological sampling at 4 juvenile traps and 1 adult trap, and snorkel, redd, and carcass surveys. It was impossible to get commitments from habitat partners this early in the process for FY2000. They have funded much work in 1997 and 1998 and if the funding continues their contributions will exceed BPA by a factor of two.

Section 9. Key personnel

Dan Rawding is the project manager. He has over a decade of natural production monitoring

experience with both adult and juveniles. He works part time on the Wind River Watershed Project providing natural production monitoring to support a watershed restoration product designed to rebuild wild summer steelhead. The subcontract is with Travis Coley (USFWS), who has two decades of experience with natural production monitoring adult and juvenile salmonids including direct experience on Cedar Creek.

Resume for: Daniel J. Rawding

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Experience

1994--Present Fish Biologist, Washington Dept. of Fish and Wildlife, Southwest Region, Vancouver, WA.

Current Responsibilities: As the agencies steelhead and sea-run cutthroat stock assessment and harvest specialist I am currently responsible for development of adult and juvenile population estimates from the mouth of the Columbia to the Klickitat River, development and implementation of recovery plans for all Lower Columbia River tributaries and reintroduction plans for the Cowlitz and White Salmon rivers, and development and implementation of mainstem and tributary harvest regulations.

1993 District Fish Biologist, Wa. Dept. of Fish and Wildlife, Region 5, Vancouver, WA.

1989-1992 Fish Biologist, Wa. Dept. of Fish and Wildlife, Steelhead Program, Olympia, WA.

1986-1988 Fish Biologist, U.S. Army Corps of Engineers, Cascade Locks, OR.

1983-1986 Fish Biologist, Wa. Dept. of Fish and Wildlife, Steelhead Program, Forks, WA.

1982-1985 Fishing Guide, Royal Coachman Lodge, Dillingham AK.

1984 Fisheries Technician, Wa. Dept. of Nat. Resources, Fish Program, Forks, WA.

1981 Fisheries Technician, U.S. Forest Service, Tongass National Forest, Sitka, AK.

Education:	School	Degree and Date Received
	University of Washington	B.S Fishery Science, 1982

Expertise: The primary area of my expertise is steelhead and sea-run cutthroat biology and management including population dynamics, life history, stream ecology, stock assessment, and harvest management.

Publications and Reports (five most relevant)

Rawding, D.J. 1997. Stock status update for steelhead in the lower Columbia River, Washington. Washington Department of Fish and Wildlife. Olympia, WA.

Hale, D.A, and D.J. Rawding. 1997. Columbia River Fish Management Plan -- Winter steelhead, all species review . Washington Department of Fish and Wildlife. Olympia, WA.

Rawding, D.J. 1997. Wind River smolt monitoring report. Washington Department of Fish and Wildlife, Southwest Washington Region, Vancouver, WA.

Hale, D.A. and D.J. Rawding. 1997. Annual anadromous gamefish report. Washington Department of Fish and Wildlife. Vancouver, WA.

Rawding, D.J. and D.A. Hale. 1996. Annual anadromous gamefish report. Washington Department of Fish and Wildlife. Vancouver, WA.

Section 10. Information/technology transfer

This project will produce annual reports that will reach many professional fish biologists and managers. Data will be included in the Coordinated Information System and will be provided to NMFS to address ESA issues including biological opinions for listed Lower Columbia River stocks. In addition results will be presented at agency and interagency workshops. Since this project support local watershed efforts, non technical presentations will be made at public meetings.

Congratulations!